

# PATENT ABSTRACTS OF JAPAN

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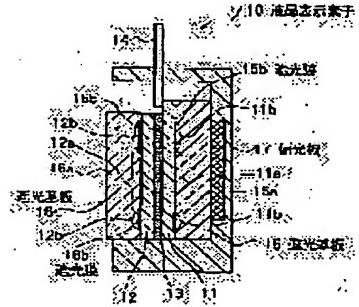
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## (54) LIQUID CRYSTAL DISPLAY ELEMENT AND PROJECTION TYPE LIQUID CRYSTAL DISPLAY DEVICE FORMED BY USING THE SAME

### (57)Abstract:

PROBLÈM TO BE SOLVED: To suppress the deterioration in the characteristics of liquid crystals by heat and light by accurately shielding the light of regions exclusive of the photoirradiation regions corresponding to effective pixel parts.

SOLUTION: The light shielding plates 15, 16 which are tightly adhered to the rear surface of a driving substrate 11 and the front surface of a counter substrate 12 are constituted by forming frame-shaped light shielding films 15b, 16b in the regions facing the non-photoirradiation regions 11b, 12b of the driving substrate and counter substrate on the front surfaces of transparent substrates 15a, 16b. The light shielding films having high light shieldability of  $\geq 3.0$  in, for example, an OD(optical density) value are used. These films are formed as thin films in order to suppress the generation of a stress distortion (warpage of glass) by adhesives at the time of adhesion. Since the light shielding films are formed by conductive films consisting of aluminum, etc., and are grounded, the films have a shielding function as well.



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CLAIMS

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[Claim(s)]

[Claim 1] The 1st substrate which has a non-light exposure field corresponding to an optical exposure field and fields other than the effective pixel section corresponding to the effective pixel section, respectively, The 2nd substrate by which carried out the liquid crystal layer in between, and opposite arrangement was carried out at the 1st substrate while countering this 1st substrate and having the optical exposure field and the non-light exposure field, The liquid crystal display component characterized by having the protection-from-light substrate to which it was stuck by one [ at least ] substrate of the 1st substrate and the 2nd substrate while countering the non-light exposure field of the 1st substrate of a transparency substrate, and one [ at least ] substrate of the 2nd substrate and forming the light-shielding film.

[Claim 2] The liquid crystal display component according to claim 1 which optical density is formed for said light-shielding film with three or more ingredients, and is characterized by thickness being 20 micrometers or less.

[Claim 3] The liquid crystal display component according to claim 1 characterized by forming said light-shielding film with a conductive ingredient.

[Claim 4] Furthermore, the liquid crystal display component according to claim 1 characterized by having the metal frame thermally combined to said protection-from-light substrate.

[Claim 5] In the projection mold liquid crystal display for making it project on a projection screen and performing image display, after leading the color from the light source to the pixel of a liquid crystal display component and becoming irregular according to a playback image with said liquid crystal display component The 1st substrate with which said liquid crystal display component has a non-light exposure field corresponding to an optical exposure field and fields other than the effective pixel section corresponding to the effective pixel section, respectively, The 2nd substrate by which carried out the liquid crystal layer in between, and opposite arrangement was carried out at the 1st substrate while countering this 1st substrate and having the optical exposure field and the non-light exposure field, The projection mold liquid crystal display characterized by having the protection-from-light substrate to which it was stuck by one [ at least ] substrate of the 1st substrate and the 2nd substrate while countering the non-light exposure field of the 1st substrate of a transparency substrate, and one [ at least ] substrate of the 2nd substrate and forming the light-shielding film.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention relates to the projection mold liquid crystal display using the liquid crystal display component and this which have protection-from-light structure.

#### [0002]

[Description of the Prior Art] The display (henceforth a liquid crystal projector) of the projection mold which displays by projecting on the screen other than the display of a direct viewing type is shown in a liquid crystal display. Among this liquid crystal projector, after carrying out the spectrum of the light emitted from the single source of the white light to the three primary colors for color display with a color separation means, leading each primary lights to the pixel (liquid crystal cell) of the liquid crystal display component corresponding to that color and becoming irregular here according to a playback image, an electrochromatic display projector is made to project on a screen, and displays a color picture. Such a liquid crystal projector is divided roughly into the veneer method constituted using the liquid crystal display component (liquid crystal panel) equipped with red, such as a dichroic mirror, green, and the color separation means of three blue colors one sheet, and 3 plate methods which arranged the monochrome liquid crystal panel for every colored light way of red, green, and blue, respectively, and constituted it using the liquid crystal panel of three sheets on the whole.

[0003] By the way, such a liquid crystal projector has the metal halide lamp which considers as the light source, for example, generally emits a powerful light, and reflects the light from this metal halide lamp ahead with the reflecting mirror of a spheroid mold. Ahead of this light source, a heat ray cut-off filter, an incidence side polarizing plate, and a condenser lens are arranged in this order, and the liquid crystal display component, the outgoing radiation side polarizing plate, the projection lens, and the projection screen are further arranged ahead of the condenser lens. That is, after unnecessary infrared radiation is removed by the heat ray cut-off filter, a powerful light source light by which outgoing radiation was carried out from the light source (metal halide lamp) passes an incidence side polarizing plate, and it is condensed with a condenser lens, it carries out incidence to a liquid crystal display component, and it is modulated here according to a playback image. After the light modulated in the liquid crystal display component penetrates an outgoing radiation side polarizing plate, expansion projection is carried out with a projection lens, and, thereby, an image copies it out on a front projection screen.

#### [0004]

[Problem(s) to be Solved by the Invention] However, in the above liquid crystal projectors, it originated in the heat generated by light source light, and the following problems had arisen. That is, the thickness is about 2mm and the liquid crystal display component used for such a liquid crystal projector is comparatively thin. Therefore, when unevenness is in light-source luminous-intensity-distribution, the so-called hot spot where light concentrates locally and a liquid crystal display component is heated partially may occur. The field of such a hot spot will spoil remarkably the grace of the image by which permeability differed from the perimeter, therefore expansion projection was carried out. Moreover, the temperature of a liquid crystal display component rose with the radiant heat from the light source, a light strong also against the driver element section in which TFT etc. was formed (Thin Film Transistor, thin film transistor) hit, and there was also a problem of the property of liquid crystal deteriorating and it becoming impossible to achieve a display function by both heat and light.

[0005] From such a thing, the device for cooling a liquid crystal display component is incorporated by

the conventional liquid crystal projector. The air-cooling mold which cools by ventilation as a method of a cooler style, and the liquid cooling mold which cools with a liquid are adopted.

[0006] However, in order to cool by ventilation, when dust dances within equipment, dust adhered to the liquid crystal display component and the lens and the cooler style of an air-cooling mold is projected by the liquid crystal projector, it has the problem that a foreign matter will copy out on a screen. Moreover, in order to acquire sufficient cooling effect, when blast weight was increased, the noise became intense by high-speed rotation of a fan, and there was a problem that what also has a still bigger fan was needed, and equipment was enlarged. On the other hand, as a cooler style of a liquid cooling mold, there are some which were indicated by JP,6-58474,B, for example. However, since it is necessary to enclose the liquid which turns into a heat exchange medium by this method, there are problems various at the point of dependability, such as pressure omission at the time of a temperature rise, gassing, a mixing foreign matter, and a cooling liquid spill. Especially, in the case of a water cooling type, the rust of metal components etc. poses a problem. Moreover, in order to cool, a lot of liquids are needed, and there is a problem that the cooler style itself will be enlarged. Furthermore, by this method, although there is also a thing of solid-state cooling system which attached thermoelectric-cooling equipments, such as a Peltier device, while the cost of the whole liquid crystal projector becomes high, sufficient cooling effect cannot be acquired.

[0007] this invention be made in view of this trouble , and by shade fields other than the optical exposure field corresponding to the effective pixel section with a sufficient precision , the purpose be to offer the projection mold liquid crystal display using the liquid crystal display component and this which can miniaturize a cooler style while being able to control property degradation of the liquid crystal by heat or light .

[0008]

[Means for Solving the Problem] The 1st substrate with which the liquid crystal display component concerning this invention has a non-light exposure field corresponding to an optical exposure field and fields other than the effective pixel section corresponding to the effective pixel section, respectively, The 2nd substrate by which carried out the liquid crystal layer in between, and opposite arrangement was carried out at the 1st substrate while countering this 1st substrate and having the optical exposure field and the non-light exposure field, While countering the non-light exposure field of the 1st substrate of a transparency substrate, and one [ at least ] substrate of the 2nd substrate and forming a light-shielding film; it has the protection-from-light substrate to which it was stuck by one [ at least ] substrate of the 1st substrate and the 2nd substrate.

[0009] Moreover, the projection mold liquid crystal display concerning this invention is set to what is made to project on a projection screen and performs image display, after leading the color from the light source to the pixel of a liquid crystal display component and becoming irregular according to a playback image with a liquid crystal display component. The 1st substrate with which a liquid crystal display component has a non-light exposure field corresponding to an optical exposure field and fields other than the effective pixel section corresponding to the effective pixel section, respectively, The 2nd substrate by which carried out the liquid crystal layer in between, and opposite arrangement was carried out at the 1st substrate while countering this 1st substrate and having the optical exposure field and the non-light-exposure field, While countering the non-light exposure field of the 1st substrate of a transparency substrate, and one [ at least ] substrate of the 2nd substrate and forming a light-shielding film, it constitutes so that it may have the protection-from-light substrate to which it was stuck by one [ at least ] substrate of the 1st substrate and the 2nd substrate.

[0010] With the liquid crystal display component of this invention, the incident light to fields other than an optical exposure field is shaded by the light-shielding film to which it was prepared in the transparency substrate and stuck by the substrate, and, thereby, the temperature rise of a liquid crystal display component is controlled.

[0011] In the projection mold liquid crystal display by this invention, the color from the light source is led

to the pixel of a liquid crystal display component. At this time, with a liquid crystal display component, the incident light to fields other than an optical exposure field is shaded by the light-shielding film to which it was prepared in the transparency substrate and stuck by the substrate, and, thereby, the temperature rise of a liquid crystal display component is controlled. Thereby, with a liquid crystal display component, the modulation of a playback image is performed with a sufficient precision, and image display of high quality is performed on a projection screen.

[0012]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing.

[0013] Drawing 1 and drawing 2 express the configuration of the liquid crystal display component concerning the gestalt of 1 operation of this invention, and the condition and drawing 2 as which drawing 1 regarded the liquid crystal display component 10 from the transverse plane express the cross-section structure of the direction of a view of X-X-ray of drawing 1, respectively. The liquid crystal display component 10 is what carried out opposite arrangement and constituted the drive substrate 11 as the 1st substrate, and the opposite substrate 12 as the 2nd substrate, and the liquid crystal layer 13 is held between these drive substrate 11 and the opposite substrate 12. It has the effective pixel section by which the drive substrate 11 is formed with the transparent bodies, such as glass, and the pixel electrode and switching element (TFT (Thin Film Transistor, thin film transistor)) of transparency which were arranged for example, in the shape of a matrix for two or more pixels of every were formed in the center section, and the circumference circuit including a level drive circuit and a vertical-drive circuit is formed in the perimeter of this effective pixel section. The effective pixel section is optical exposure field 11a which can irradiate light here, and it is non-light exposure field 11b to which a circumference circuit should irradiate light and which does not come out. The opposite substrate 12 is formed by the transparency substrate as well as the drive substrate 11, and the counterelectrode (not shown) is formed in the opposed face with the drive substrate 11. In addition, about the opposite substrate 12, the field of optical exposure field 12a and others is set to non-light exposure field 12b for the field which counters optical exposure field 11a by the side of the drive substrate 11. The upper part is broadly formed rather than the opposite substrate 12, and, as for the drive substrate 11, the flexible connector 14 for external connection is connected to the extension section.

[0014] With the gestalt of this operation, the protection-from-light substrate 16 has pasted [ in the front face of the protection-from-light substrate 15 and the opposite substrate 12 ] the tooth back of the drive substrate 11 directly with the adhesives (for example, silicon system resin and gel adhesives) of low stress, respectively. The polarizing plate 17 for deflecting the light which carried out outgoing radiation from the liquid crystal display component 10 pastes the external surface of the protection-from-light substrate 15, and is united with it. The protection-from-light substrates 15 and 16 and a polarizing plate 17 are thermally combined while being fixed with the silicon system resin which mixed conductive ingredients, such as thermally conductive adhesives, for example, an alumina etc., to the metal frame 18 for heat dissipation (cooling).

[0015] The protection-from-light substrate 15 forms frame-like light-shielding film 15b in the field which counters non-light exposure field 11b of the drive substrate 11 of the front face of transparency substrate 15a as shown also in drawing 3. The protection-from-light substrate 16 of another side forms frame-like light-shielding film 16b in the field which counters non-light exposure field 12b of the opposite substrate 12 of the front face of transparency substrate 16a similarly, and is constituted. Both the transparency substrates 15a and 16a are formed with heat-resisting glass, for example, quartz glass. These transparency substrates 15a and 16a are 2mm or more so that the focus of foreign matters, such as dust with which the thickness adhered to the front face respectively, may not be made to connect, the front face, i.e., the pixel section, of the drive substrate 11. 3.0 or more protection-from-light nature has respectively high OD (Optical Density: optical density) value, for example, and light-shielding films 15b and 16b have the desirable thing of 20nm or less of thickness, in order to control generating of the

stress distortion (namely, curvature of a transparency substrate) by the adhesives for moreover making the drive substrate 11 and the opposite substrate 12 paste, respectively. It can form by print processes using for example, epoxy system resin as light-shielding films 15b and 16b. Moreover, although these light-shielding films 15b and 16b may be formed by the insulating material, while forming conductive film, such as silver (Ag), chromium (Cr), aluminum (aluminum), and carbon (C), for example with vacuum deposition, in addition to a protection-from-light function, the shielding function of the liquid crystal display component 10 can be given by grounding this conductive film.

[0016] Thus, with the gestalt of this operation, since protection-from-light nature is pasting up directly the protection-from-light substrates 15 and 16 which come to form the thin light-shielding films 15b and 16b directly on transparency substrate 15a and 16a highly, respectively on the external surface of the drive substrate 11 and the opposite substrate 12, light-shielding films 15b and 16b are in the condition of having stuck to the front face of the drive substrate 11 and the opposite substrate 12. Therefore, the incidence of the light to each \*\*\* exposure fields 11b and 12b of the drive substrate 11 and the opposite substrate 12 can be prevented with a sufficient precision. Moreover, mixing of foreign matters, such as dust of between light-shielding film 15b and the drive substrates 11 and a between [ light-shielding film 16b and the opposite substrates 12 ], can be prevented. Furthermore, since each sticks [ between light-shielding film 15b and the drive substrates 11 and between light-shielding film 16b and the opposite substrates 12 ] and the layer of air is not formed, the heat generated by incident light radiates heat effectively from the metal frame 18 through the protection-from-light substrates 15 and 16. Therefore, the cooling effect of the liquid crystal display component 10 can be raised, without using a thing large-sized as a cooling means.

[0017] Drawing 4 expresses the configuration of the protection-from-light substrate 30 concerning the gestalt of other operations of this invention. Although the protection-from-light substrates 15 and 16 of the gestalt of the above-mentioned implementation prepared the light-shielding film only in the field which counters a circumference circuit among non-light exposure fields, respectively partially, they form the black light-shielding film 32 with vacuum deposition in the protection-from-light substrate 30 of the gestalt of this operation covering the whole surface of the field which counters the non-light exposure field of the front face of the transparency substrate 31, and also its side face. Moreover, as the Y-Y cross section of drawing 4 was expanded and shown in this light-shielding film 32 at drawing 5 R>5, concave heights 32a is formed in the front face. The light-shielding film 32 is grounded while being formed like the gestalt of the above-mentioned implementation with a conductive ingredient (Ag), for example, silver, chromium (Cr); aluminum (aluminum); carbon (C); etc.

[0018] In this protection-from-light substrate 30, since the black light-shielding film 32 is formed also in the side face of the transparency substrate 31, in addition to the effectiveness of the gestalt of the above-mentioned implementation, the incidence of the light from the side face of the transparency substrate 31 and unnecessary reflection in a side face can be prevented. Moreover, since concave heights 32a is formed in the front face of a light-shielding film 32, reflection of light can be controlled more.

[0019] Next, the projection mold liquid crystal display constituted using the above liquid crystal display components is explained.

[0020] Drawing 6 expresses the outline configuration of the projection mold liquid-crystal display 50 . . . . . constituted using the liquid crystal display component mentioned above. This projection mold liquid crystal display 50 For example, the light source 51 which consists of spheroid mold reflecting mirror 51b for reflecting ahead the white light emitted from metal halide lamp 51a which emits a powerful light source light (white light), and this metal halide lamp 51a, The heat ray cut-off filter 52 for removing unnecessary infrared radiation from the white light emitted from this light source 51, The convex lens 53 for making the light which passed this heat ray cut-off filter 52 condense, The reflective mirror which color separation of the light which penetrated this convex lens 53 is carried out [ mirror ] to the three-primary-colors light of R (red), G (green), and B (blue), and reflects it in it (dichroic mirror) (the mirror to

which only one color corresponds by a diagram is illustrated) 54 omitted about the mirror corresponding to other colors, and the incidence side polarizing plate 55 for carrying out the linearly polarized light of the reflected light by which color separation was carried out by this reflective mirror 54, It has the liquid crystal display component 10 which carries out outgoing radiation after becoming irregular alternatively to each colored light which penetrated this incidence side polarizing plate 55, and the projection lens 56 which carries out condensing composition of the outgoing radiation light from this liquid crystal display component 10, and is projected on a screen (not shown). The liquid crystal display component 10 is used with the gestalt of operation of drawing 1.

[0021] Next, an operation of this projection mold liquid crystal display is explained.

[0022] After unnecessary infrared radiation is removed by the heat ray cut-off filter 52, it is separated into the three primary colors of R, G, and B by the reflective mirror (dichroic mirror) through a convex lens 53, and incidence of the white light emitted from the light source lamp 51 is carried out through the incidence side polarizing plate 55 to the liquid crystal display component 10. The protection-from-light substrates 15 and 16 are arranged as mentioned above at the liquid crystal display component 10, and the incident light to the non-light exposure field of the liquid crystal display component 10 shades alternatively, and makes only the incident light to an optical exposure field penetrate. To each colored light which carried out incidence to the optical exposure field of the liquid crystal display component 10, a modulation is performed alternatively, through the polarizing plate 17 by the side of outgoing radiation, the modulated light is led to the projection lens 56, and condensing composition is carried out. Thereby, an image is formed on a projection screen (not shown).

[0023] thus, in the projection mold liquid crystal display 50 concerning the gestalt of this operation Since it was made to shade alternatively with the protection-from-light substrates 15 and 16 which prepared the powerful incident light of the liquid crystal display component 10 from the light source lamp 51 in the external surface of the drive substrate 11 and the opposite substrate 12 Property degradation of the liquid crystal generated since an optical exposure field (driver element section) is heated by powerful light and serves as an elevated temperature can be prevented, and the grace of the image by which expansion projection was therefore carried out can be raised.

[0024] Although the gestalt of operation was mentioned above and this invention was explained, this invention is not limited to the gestalt of the above-mentioned implementation, and is variously deformable. for example, the gestalt of the above-mentioned implementation — setting — a protection-from-light substrate — the drive substrate 11 and the opposite substrate 12 — although it was made to make it stick about each, only one of substrates is made to correspond and you may make it form a protection-from-light substrate However, it is desirable to form a protection-from-light substrate in the substrate (opposite substrate) side by the side of the incidence of light at least. Moreover, in the gestalt of operation of drawing 4 , although the light-shielding film 32 was formed ranging from the front face to a side face of the transparency substrate 31, this side-face part may constitute separately, so that black adhesives may be applied. Furthermore, although the gestalt of the above-mentioned implementation explained the color projection mold liquid crystal display, you may make it apply to a monochrome projection mold liquid crystal display.

[0025]

[Effect-of-the-Invention] Since it was made to stick the protection-from-light substrate in which the light-shielding film was formed on the external surface of one [ at least ] substrate of the 1st substrate and the 2nd substrate according to the liquid crystal display component according to claim 1 to 4 as explained above, while being able to prevent the incidence of the light to fields other than an optical exposure field with a sufficient precision, the effectiveness that it can prevent that dust etc. mixes is done so.

[0026] Since the light-shielding film was especially formed with the conductive ingredient according to the liquid crystal display component according to claim 3, in addition to the effectiveness of a liquid crystal display component according to claim 1, the shielding effect by the light-shielding film can be

obtained by grounding a light-shielding film.

[0027] Furthermore, since it had the metal frame thermally combined to the protection-from-light substrate according to the liquid crystal display component according to claim 4, in addition to the effectiveness of a liquid crystal display component according to claim 1, the cooling effect is also acquired by the heat dissipation from a metal frame, and degradation of the property of liquid crystal can be prevented.

[0028] Moreover, according to the projection mold liquid crystal display according to claim 5, since the liquid crystal display component of this invention was used, the effectiveness that image grace improves is done so.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the front view of the liquid crystal display component concerning the gestalt of 1 operation of this invention.

[Drawing 2] It is the sectional view of the direction of a view of X-X-ray of drawing 1.

[Drawing 3] It is the top view of the protection-from-light substrate in the liquid crystal display component of drawing 2.

[Drawing 4] It is the perspective view of the protection-from-light substrate concerning the gestalt of other operations of this invention.

[Drawing 5] It is the sectional view of the direction of a view of the Y-Y line of the protection-from-light substrate of drawing 4.

[Drawing 6] It is drawing showing the outline configuration of the projection mold liquid crystal display constituted using the liquid crystal display component of this invention.

[Description of Notations]

10 [ — An optical exposure field, 11b, 12b / — A non-light exposure field, 13 / — A liquid crystal layer, 14 / — Flexible connector / 15 16 / — A light-shielding film, 17 / — A polarizing plate, 18 / — Metal frame / — A protection-from-light substrate, 15a, 16a — A transparency-substrate, 15b-16b ] — A liquid crystal display component, 11 — A drive substrate (the 1st substrate), 12 — An opposite substrate (the 2nd substrate), 11a, 12a

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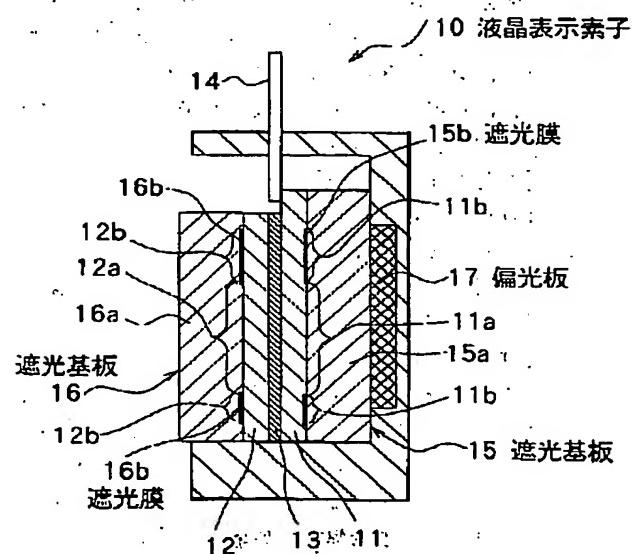
(54)【発明の名称】 液晶表示素子およびこれを用いた投射型液晶表示装置

(57)【要約】 (修正有)

【課題】 有効画素部に対応する光照射領域以外の領域を精度よく遮光することにより、熱や光による液晶の特性劣化を抑制する。

【解決手段】 駆動基板11の背面と対向基板12の前面とに遮光基板15, 16をそれぞれ密着させる遮光基板15, 16は、透明基板15a, 16aの表面の駆動基板、対向基板の非光照射領域11b, 12bに対向する領域に枠状の遮光膜15b, 16bを形成して成る。

遮光膜は例えばO.D(Optical Density: 光学濃度)値が3.0以上の遮光性が高いものとし、またに接着時の接着剤による応力歪(ガラスの反り)の発生を抑制するために薄膜とする。アルミニウム等の導電性膜により形成され接地されているのでシールド機能も有している。



(2)

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## 【特許請求の範囲】

【請求項1】 有効画素部に対応して光照射領域および有効画素部以外の領域に対応して非光照射領域をそれぞれ有する第1の基板と、

この第1の基板に対向して光照射領域および非光照射領域を有すると共に液晶層を間にて第1の基板に対向配置された第2の基板と、

透明基板の第1の基板および第2の基板の少なくとも一方の基板の非光照射領域に対向して遮光膜が形成されると共に第1の基板および第2の基板の少なくとも一方の基板に密着された遮光基板とを備えたことを特徴とする液晶表示素子。

【請求項2】 前記遮光膜が光学濃度が3以上の材料で形成され、かつ膜厚が $20\text{ }\mu\text{m}$ 以下であることを特徴とする請求項1記載の液晶表示素子。

【請求項3】 前記遮光膜が導電性材料により形成されたことを特徴とする請求項1記載の液晶表示素子。

【請求項4】 更に、前記遮光基板に対して熱的に結合された金属枠を備えたことを特徴とする請求項1記載の液晶表示素子。

【請求項5】 光源からの色を液晶表示素子の画素に導き、前記液晶表示素子で再生画像に応じて変調した後、投影スクリーン上に投影させて画像表示を行うための投射型液晶表示装置において、前記液晶表示素子が、有効画素部に対応して光照射領域および有効画素部以外の領域に対応して非光照射領域をそれぞれ有する第1の基板と、この第1の基板に対向して光照射領域および非光照射領域を有すると共に液晶層を間にて第1の基板に対向配置された第2の基板と、透明基板の第1の基板および第2の基板の少なくとも一方の基板の非光照射領域に対向して遮光膜が形成されると共に第1の基板および第2の基板の少なくとも一方の基板に密着された遮光基板とを備えたことを特徴とする投射型液晶表示装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、遮光構造を有する液晶表示素子およびこれを用いた投射型液晶表示装置に関する。

## 【0002】

【従来の技術】 液晶表示装置には、直視型の表示装置のほかに、スクリーンに投影して表示を行う投射型の表示装置（以下、「液晶プロジェクタ」という）がある。この液晶プロジェクタのうち例えばカラー液晶プロジェクタは、単一の白色光源から放射される光を色分離手段によりカラー表示のための3原色に分光してそれぞれの原色光をその色に対応する液晶表示素子の画素（液晶セル）に導き、ここで再生画像に応じて変調した後、スクリーン上に投影させてカラー画像の表示を行うものである。このような液晶プロジェクタは、ダイクロイックミラー

などの赤、緑、青の3色の色分離手段を備えた液晶表示素子（液晶パネル）を1枚用いて構成した単板方式と、モノクロ液晶パネルを赤、緑、青の各色光路ごとにそれぞれ配し全体で3枚の液晶パネルを用いて構成した3板方式とに大別される。

【0003】 ところで、このような液晶プロジェクタは、一般に、光源として例えば強力な光を発するメタルハライドランプを有し、このメタルハライドランプからの光を回転楕円体型の反射鏡により前方に反射させるようになっている。この光源の前方には熱線カットフィルタ、入射側偏光板および集光レンズがこの順で配列され、更に集光レンズの前方には液晶表示素子、出射側偏光板、投影レンズおよび投影スクリーンが配列されている。すなわち、光源（メタルハライドランプ）から出射された強力な光源光は、熱線カットフィルタにより不要な赤外線が除去された後、入射側偏光板を通過し、集光レンズにより集光されて液晶表示素子に入射し、ここで再生画像に応じて変調される。液晶表示素子において変調された光は出射側偏光板を透過した後、投影レンズにより拡大投影され、これにより前方の投影スクリーンに画像が写し出される。

## 【0004】

【発明が解決しようとする課題】 しかしながら、上述のような液晶プロジェクタにおいては、光源光により発生する熱に起因して以下の問題が生じていた。すなわち、このような液晶プロジェクタに用いられる液晶表示素子は、その厚みが $2\text{ mm}$ 程度であり比較的薄くなっている。そのため、光源光の強度分布にむらがあった場合、局部的に光が集中して液晶表示素子が部分的に加熱される、所謂ホットスポットが発生することがある。このようなホットスポットの領域は周囲と透過率が異なり、そのため拡大投影された画像の品位を著しく損なうこととなる。また、光源からの輻射熱により液晶表示素子の温度が上昇し、TFT（Thin Film Transistor、薄膜トランジスタ）等が形成された駆動素子部にも強い光が当たり、熱と光の両方によって液晶の特性が劣化し表示機能を果たせなくなるという問題もあった。

【0005】 このようなことから、従来の液晶プロジェクタでは、液晶表示素子を冷却するための機構が組み込まれている。冷却機構の方式としては送風により冷却を行う空冷型と、液体により冷却を行う液冷型が採用されている。

【0006】 しかしながら、空冷型の冷却機構は送風により冷却を行うため、装置内でダストが舞い液晶表示素子およびレンズにダストが付着すると、液晶プロジェクタで投影した際に、画面に異物が写し出されてしまうという問題がある。また、十分な冷却効果を得るために送風量を増やすと、ファンの高速回転により騒音が激しくなり、更にファンも大きなものが必要となって装置が大型化するという問題があった。一方、液冷型の冷却機構

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としては、例えば特公平6-58474号公報に開示されたものがある。しかしながら、この方式では熱交換媒体となる液体を封入する必要があるので、温度上昇時の圧力抜き、気泡発生、混入異物および冷却液漏れ等の信頼性の点で種々の問題がある。特に、水冷式の場合には、金属部品の錆等も問題となる。また、冷却を行うためには多量の液体が必要となり、冷却機構自体が大型化してしまうという問題がある。更に、ペルチェ素子等の電子冷却装置を取り付けた固体冷却方式のものもあるが、この方式では、液晶プロジェクタ全体のコストが高くなると共に十分な冷却効果を得ることができない。

【0007】本発明はかかる問題点に鑑みてなされたもので、その目的は、有効画素部に対応する光照射領域以外の領域を精度よく遮光することにより、熱や光による液晶の特性劣化を抑制できると共に冷却機構を小型化することができる液晶表示素子およびこれを用いた投射型液晶表示装置を提供することにある。

#### 【0008】

【課題を解決するための手段】本発明に係る液晶表示素子は、有効画素部に対応して光照射領域および有効画素部以外の領域に対応して非光照射領域をそれぞれ有する第1の基板と、この第1の基板に対向して光照射領域および非光照射領域を有すると共に液晶層を間にて第1の基板に対向配置された第2の基板と、透明基板の第1の基板および第2の基板の少なくとも一方の基板の非光照射領域に対向して遮光膜が形成されると共に第1の基板および第2の基板の少なくとも一方の基板に密着された遮光基板とを備えている。

【0009】また、本発明に係る投射型液晶表示装置は、光源からの色を液晶表示素子の画素に導き、液晶表示素子で再生画像に応じて変調した後、投影スクリーン上に投影させて画像表示を行うものにおいて、液晶表示素子が、有効画素部に対応して光照射領域および有効画素部以外の領域に対応して非光照射領域をそれぞれ有する第1の基板と、この第1の基板に対向して光照射領域および非光照射領域を有すると共に液晶層を間にて第1の基板に対向配置された第2の基板と、透明基板の第1の基板および第2の基板の少なくとも一方の基板の非光照射領域に対向して遮光膜が形成されると共に第1の基板および第2の基板の少なくとも一方の基板に密着された遮光基板とを備えるように構成したものである。

【0010】本発明の液晶表示素子では、光照射領域以外の領域への入射光は透明基板に設けられ基板に密着された遮光膜により遮光され、これにより液晶表示素子の温度上昇が抑制される。

【0011】本発明による投射型液晶表示装置では、光源からの色は液晶表示素子の画素に導かれる。このとき、液晶表示素子では、光照射領域以外の領域への入射光は透明基板に設けられ基板に密着された遮光膜により遮光され、これにより液晶表示素子の温度上昇が抑制さ

れる。これにより液晶表示素子では精度良く再生画像の変調が行われ、投影スクリーン上に高品質の画像表示が行われる。

#### 【0012】

【発明の実施の形態】以下、本発明の実施の形態について図面を参照して詳細に説明する。

【0013】図1および図2は本発明の一実施の形態に係る液晶表示素子の構成を表すもので、図1は液晶表示素子10を正面から見た状態、図2は図1のX-X線の矢視方向の断面構造をそれぞれ表すものである。液晶表示素子10は、第1の基板としての駆動基板11と第2の基板としての対向基板12を対向配置して構成したもので、これら駆動基板11と対向基板12との間には液晶層13が保持されている。駆動基板11は例えばガラスなどの透明体により形成されており、中央部に複数の画素毎に例えばマトリクス状に配列された透明の画素電極およびスイッチング素子(TFT (Thin Film Transistor, 薄膜トランジスタ) )が形成された有効画素部を備え、この有効画素部の周囲に水平駆動回路および垂直駆動回路を含む周辺回路が形成されている。ここで、有効画素部が光を照射される光照射領域11aであり、周辺回路が光を照射されるべきでない非光照射領域11bである。対向基板12は駆動基板11と同様に透明基板により形成され、駆動基板11との対向面には対向電極(図示せず)が形成されている。なお、対向基板12については駆動基板11側の光照射領域11aに対向する領域を光照射領域12a、その他の領域を非光照射領域12bとする。駆動基板11は対向基板12よりもその上部が幅広く形成されており、その拡幅部には外部接続用のフレキシブルコネクタ14が接続されている。

【0014】本実施の形態では、駆動基板11の背面に遮光基板15、また対向基板12の前面に遮光基板16がそれぞれ低応力の接着剤(例えばシリコン系樹脂やゲル状接着剤)により直接接着されている。遮光基板15の外面には、液晶表示素子10から出射した光を偏向させるための偏光板17が接着され一体化されている。遮光基板15, 16および偏光板17は放熱(冷却)用の金属枠18に対して熱伝導性接着剤、例えばアルミナ等の導電性材料を混入したシリコン系樹脂により固定されると共に熱的に結合されている。

【0015】遮光基板15は、図3にも示したように透明基板15aの表面の駆動基板11の非光照射領域11bに対向する領域に枠状の遮光膜15bを形成したものである。他方の遮光基板16も同様に、例えば、透明基板16aの表面の対向基板12の非光照射領域12bに対向する領域に枠状の遮光膜16bを形成して構成されている。透明基板15a, 16aは共に耐熱ガラス例えば石英ガラスにより形成されている。これら透明基板15a, 16aは、各々その厚さがその表面に付着した埃などの異物の焦点を駆動基板11の表面すなわち画素部

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に結ばせないように例えば2mm以上となっている。遮光膜15b, 16bは各々例えばOD(Optical Density: 光学濃度)値が3.0以上の遮光性が高いもので、しかも駆動基板11および対向基板12にそれぞれ接着させるための接着剤による応力歪(すなわち、透明基板の反り)の発生を抑制するために膜厚20nm以下のものが望ましい。遮光膜15b, 16bとしては例えばエポキシ系樹脂を用いた印刷法により形成することができる。また、これら遮光膜15b, 16bは絶縁材料により形成してもよいが、例えば蒸着法により銀(Ag), クロム(Cr), アルミニウム(Al), 炭素(C)等の導電性膜を形成すると共にこの導電性膜を接地することにより、遮光機能に加え液晶表示素子10のシールド機能を持たせることができる。

【0016】このように本実施の形態では、遮光性が高く、かつ薄い遮光膜15b, 16bをそれぞれ透明基板15a, 16a上に直接形成してなる遮光基板15, 16を駆動基板11および対向基板12の外面に直接接着させているので、遮光膜15b, 16bが駆動基板11および対向基板12の表面に密着した状態となっている。そのため駆動基板11および対向基板12の各非光照射領域11b, 12bへの光の入射を精度良く阻止することができる。また、遮光膜15bと駆動基板11との間、および遮光膜16bと対向基板12との間へのダスト等の異物の混入を防ぐことができる。更に、遮光膜15bと駆動基板11との間、および遮光膜16bと対向基板12との間がそれぞれ密着し、空気の層が形成されないため、入射光により発生した熱は遮光基板15, 16を通して金属枠18から効果的に放熱される。従って、冷却手段として大型のものを用いることなく液晶表示素子10の冷却効果を向上させることができる。

【0017】図4は本発明の他の実施の形態に係る遮光基板30の構成を表すものである。上記実施の形態の遮光基板15, 16はそれぞれ非光照射領域のうち周辺回路に対向する領域のみに部分的に遮光膜を設けるようにしたが、本実施の形態の遮光基板30では、透明基板31の表面の非光照射領域に対向する領域の全面、更にその側面にわたって黒色の遮光膜32を例えば蒸着法によって形成したものである。また、この遮光膜32には図5に図4のY-Y断面を拡大して示したように表面に凹凸部32aが形成されている。遮光膜32は上記実施の形態と同様に導電性材料例えば銀(Ag), クロム(Cr), アルミニウム(Al), 炭素(C)等で形成されると共に接地されている。

【0018】この遮光基板30では、透明基板31の側面にも黒い遮光膜32が形成されているので、上記実施の形態の効果に加え透明基板31の側面からの光の入射および側面での不要な反射を防ぐことができる。また、遮光膜32の表面に凹凸部32aが形成されているので、より光の反射を抑制することができる。

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【0019】次に、上記のような液晶表示素子を用いて構成した投射型液晶表示装置について説明する。

【0020】図6は上述した液晶表示素子を用いて構成した投射型液晶表示装置50の概略構成を表すものである。この投射型液晶表示装置50は、例えば強力な光源光(白色光)を発するメタルハライドランプ51aおよびこのメタルハライドランプ51aから放射された白色光を前方に反射するための回転枠円体型反射鏡51bからなる光源51と、この光源51から放射される白色光から不要な赤外線を除去するための熱線カットフィルタ52と、この熱線カットフィルタ52を通過した光を集光させるための凸レンズ53と、この凸レンズ53を透過した光をR(赤色), G(緑色), B(青色)の3原色光に色分離して反射させる反射ミラー(ダイクロイックミラー)(図では1色のみ対応するミラーを図示し、他の色に対応するミラーについては省略する)54と、この反射ミラー54で色分離された反射光を直線偏光させるための入射側偏光板55と、この入射側偏光板55を透過した各色光に対して選択的に変調を行ったうえで出射する液晶表示素子10と、この液晶表示素子10からの出射光を集光合成スクリーン(図示せず)上に投影する投影レンズ56とを備えている。液晶表示素子10は例えば図1の実施の形態で用いたものである。

【0021】次に、この投射型液晶表示装置の作用を説明する。

【0022】光源ランプ51より放射された白色光は熱線カットフィルタ52により不要な赤外線が除去されたのち、凸レンズ53を経て反射ミラー(ダイクロイックミラー)によりR, G, Bの3原色に分離され、入射側偏光板55を介して液晶表示素子10へ入射される。液晶表示素子10には前述のように遮光基板15, 16が配置されており、液晶表示素子10の非光照射領域への入射光は選択的に遮光し、光照射領域への入射光のみを透過させる。液晶表示素子10の光照射領域へ入射した各色光に対しては選択的に変調が行われ、変調された光は出射側の偏光板17を介して投影レンズ56に導かれて集光合成される。これにより投影スクリーン(図示せず)上に画像が形成される。

【0023】このように本実施の形態に係る投射型液晶表示装置50では、光源ランプ51からの液晶表示素子10の強力な入射光を駆動基板11および対向基板12の外面に設けた遮光基板15, 16により選択的に遮光するようにしたので、光照射領域(駆動素子部)が強力な光により熱せられ高温となるために発生する液晶の特性劣化を防ぐことができ、よって拡大投影された画像の品位を向上させることができる。

【0024】以上実施の形態を挙げて本発明を説明したが、本発明は上記実施の形態に限定されるものではなく種々変形可能である。例えば、上記実施の形態においては、遮光基板を駆動基板11および対向基板12それぞ

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れについて密着させるようにしたが、いずれか一方の基板にのみ対応させて遮光基板を設けるようにしてもよい。但し、少なくとも光の入射側の基板（対向基板）側には遮光基板を設けることが望ましい。また、図4の実施の形態においては、遮光膜32を透明基板31の表面から側面にわたって形成したが、この側面部分について別途黒色の接着剤を塗布する構成してもよい。更に、上記実施の形態ではカラー投射型液晶表示装置について説明したが、白黒の投射型液晶表示装置に適用するようにしてもよい。

[0.025]

【発明の効果】以上説明したように請求項1ないし4のいずれかに記載の液晶表示素子によれば、第1の基板および第2の基板の少なくとも一方の基板の外面に、遮光膜を形成した遮光基板を密着させるようにしたので、光照射領域以外の領域への光の入射を精度よく阻止することができると共にダスト等が混入することを防止できるという効果を奏する。

【0026】特に、請求項3記載の液晶表示素子によれば、遮光膜を導電性材料により形成するようにしたので、遮光膜を接地させることにより、請求項1記載の液晶表示素子の効果に加え、遮光膜によるシールド効果を得ることができる。

【0027】更に、請求項4記載の液晶表示素子によれば、遮光基板に対して熱的に結合された金属枠を備える

ようにしたので、請求項1記載の液晶表示素子の効果に加え、金属枠からの放熱により冷却効果も得られ、液晶の特性の劣化を防止することができる。

【0028】また、請求項5記載の投射型液晶表示装置によれば、本発明の液晶表示素子を用いるようにしたので、画像品位が向上するという効果を奏する。

### 【図面の簡単な説明】

【図1】本発明の一実施の形態に係る液晶表示素子の正面図である。

- 10 【図2】図1のX-X線の矢視方向の断面図である。

【図3】図2の液晶表示素子における遮光基板の平面図である。

【図4】本発明の他の実施の形態に係る遮光基板の斜視図である。

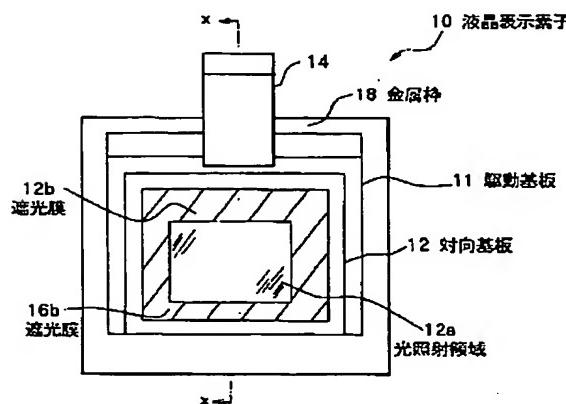
【図5】図4の遮光基板のY-Y線の矢視方向の断面図である。

【図6】本発明の液晶表示素子を利用して構成した投射型液晶表示装置の概略構成を表す図である。

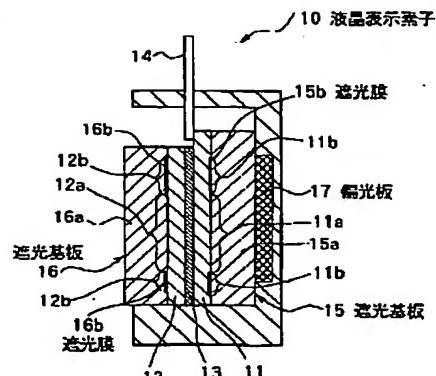
【符号の説明】

20 10…液晶表示素子、11…駆動基板(第1の基板)、  
12…対向基板(第2の基板)、11a, 12a…光照射領域、  
11b, 12b…非光照射領域、13…液晶層、  
14…フレキシブルコネクタ 15, 16…遮光基板、  
15a, 16a…透明基板、15b, 16b…遮光膜、  
17…偏光板、18…金属枠

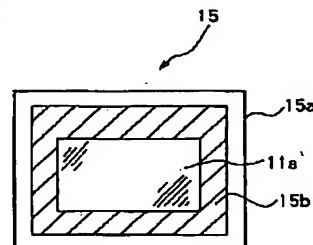
[図1]



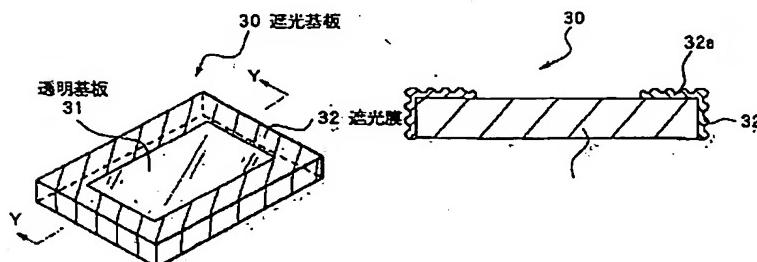
[図4]



[図3]

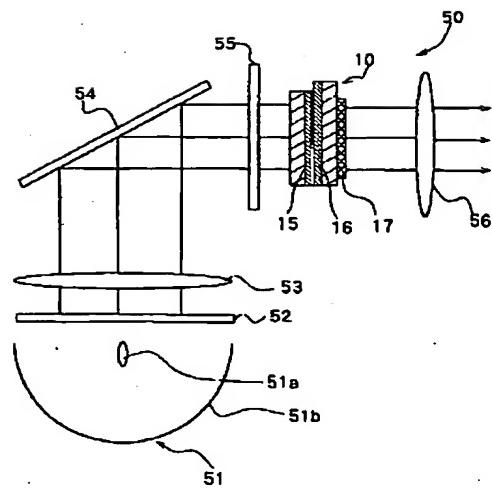


【図5】



(6)

【図6】



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